

SUGGESTED CHANGES TO THE CLAIMS

4. ~~In a~~ A method of designing an acoustic matching layer or layers of a piezoelectric transducer wherein the piezoelectric transducer comprises: ~~including~~

- a piezoelectric plate that is an electric device made of a ceramic material ~~group~~ capable of converting an electric pulse into a sound wave pulse signal,
- a back absorption layer that is a sound wave absorption layer for preventing an echo phenomenon of the piezoelectric plate,
- one or more of the acoustic matching layers that is a thin layer structure constructed in order that sound waves generated in the piezoelectric plate can be transferred in the direction of a front load, and
- an electric matching device that is an electric device for matching an external electric equipment and an electric impedance,

the improvements comprising the steps of:

- (1) computing the value of the sensitivity, pulse width and performance index of the piezoelectric transducer based on a KLM model computation and inputting a front load effective impedance “somewhere” ~~a step in which a front load effective impedance is inputted, and a sensitivity, pulse width and performance index of a piezoelectric transducer are computed based on a KLM model computation,~~
- (2) ~~a step in which~~ selecting a minimum value of a front load effective impedance is ~~selected~~ based on ~~[[a]]~~ the sensitivity, pulse width and performance index of the piezoelectric transducer computed in the step (1);

- (3) ~~a step in which a~~ inserting the selected minimum value of the front load effective impedance ~~is inserted~~ into the following formula:

$$\ln \frac{Z_{i+1}}{Z_i} = 2^{-n} C_i^n \ln \frac{Z_t}{Z_f^{(0)}}$$

where $i=0, \dots, n$, $Z_0=(Z_f)^{(0)}$, $Z_{n+1}=Z_t$,

$$C_i^n = \frac{n!}{(n-i)!i!}; \text{ and}$$

- (4) ~~a step in which~~ selecting an the impedance computed in the step (3) is ~~determined~~ as an impedance Z_1 , Z_2 , and Z_3 of each of the matching layers according to the following Table:

Impedance Number of layers	Z_1	Z_2	Z_3
1	$((Z_f)^{(0)}(Z_t))^{\frac{1}{2}}$		
2	$(Z_f)^{(0)\frac{3}{4}}(Z_t)^{\frac{1}{4}}$	$(Z_f)^{(0)\frac{1}{4}}(Z_t)^{\frac{3}{4}}$	
3	$(Z_f)^{(0)\frac{7}{8}}(Z_t)^{\frac{1}{8}}$	$(Z_f)^{(0)}(Z_t)^{\frac{1}{2}}$	$(Z_f)^{(0)\frac{1}{8}}(Z_t)^{\frac{7}{8}}$

where Z_f represents an effective impedance of front load viewed from the front side of the piezoelectric plate, and $(Z_f)^{(0)}$ is (Z_f) at the free resonant frequency, and (Z_t) is a front load impedance, and wherein the above results are obtained for a number n of the matching layers $n=1, 2$ or 3 , wherein a video waveform, not a RF waveform, is used for evaluating the sensitivity and pulse width of the piezoelectric transducer.

5. ~~In a~~ A method of designing a piezoelectric transducer, the piezoelectric transducer comprising: including

- a piezoelectric plate made of a ceramic ~~group~~ material for converting an electric pulse into a sound wave pulse signal,
- a back sound wave absorption layer for preventing an echo phenomenon of the piezoelectric plate, and
- one to three acoustic matching layers having respective impedances (Z_1, Z_2, Z_3) so that sound waves generated in the piezoelectric plate can be transferred in the direction of a front load, the improvements comprising:
 - selecting a front load impedance (Z_t) and an effective impedance of the front load (Z_f) viewed from a front side of the piezoelectric plate; and
 - determining the impedances (Z_1, Z_2, Z_3) of each of the acoustic matching layers using the following matching formula and table:

$$\ln \frac{Z_{i+1}}{Z_i} = 2^{-n} C_i^n \ln \frac{Z_t}{Z_f^{(0)}}, \text{ where } i=0, \dots, n, Z_0=(Z_f)^{(0)}, Z_{n+1}=Z_t,$$

$$C_i^n = \frac{n!}{(n-i)!i!}; \text{ and}$$

Impedance	Z_1	Z_2	Z_3
Number of layers			
1	$((Z_f)^{(0)}(Z_t))^{\frac{1}{2}}$		
2	$(Z_f)^{(0)\frac{3}{4}}(Z_t)^{\frac{1}{4}}$	$(Z_f)^{(0)1/4}(Z_t)^{\frac{3}{4}}$	
3	$(Z_f)^{(0)7/8}(Z_t)^{\frac{1}{8}}$	$(Z_f)^{(0)}(Z_t)^{\frac{1}{2}}$	$(Z_f)^{(0)1/8}(Z_t)^{\frac{7}{8}}$

Art Unit: 2834

where Z_f represents the effective impedance of front load viewed from the front side of the piezoelectric plate, and $(Z_f)^{(0)}$ is (Z_f) at the free resonant frequency, and (Z_l) is the front load impedance, ~~and the above results are obtained.~~